NASA TECH BRIEF

Freon Provides Heat Transfer for Solid CO_2 Calibration Standard

The problem:

When using solid carbon dioxide as a calibration standard, some form of liquid heat transfer medium is needed to ensure that the entire bath can be maintained within a ±0.02° F tolerance of the dry ice sublimation point for a period of one-half hour or more.

The solution:

Acetone and Freon are the only liquids found which would meet the specifications of bringing the bath to the desired temperature within 15 minutes and maintaining the bath for the required time. Although acetone gives better results, Freon TF is preferred, since acetone reacts violently in the presence of liquid oxygen.

How it's done:

The freezing point of Freon is −35°C while the sublimation point of carbon dioxide is −78.48°C. Hence, the Freon will actually freeze when used with carbon dioxide. However, if five or six hundred cc of Freon is first poured into a dewar, and then crushed carbon dioxide is slowly added to it while stirring, the Freon first freezes, but then reverts to a liquid state due to an unknown combination or possible eutectic formation. At this time, the block holding the thermometers should be placed in the dewar, and additional dry ice should be added around the perimeter, while stirring. The liquid condition will remain, and a slurry of the proper consistency will be formed over the block and thermometer holes. Additional dry ice should be added to minimize the conduction loss. Typically, a total of three to three and one-half pounds of dry ice will be required.

Notes:

1. The parameters in establishing dry ice baths are sufficiently variable so that it is difficult to predict the exact behavior of the bath in every case. In particular, variations are dependent upon whether the dry ice is crushed or merely broken into small pieces. This determines the overall dilution effect of air, which in turn varies the amount of time and heat energy required to bring the bath into equilibrium.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B66-10257

Patent status:

No patent action is contemplated by NASA.

Source: Leeds & Northrup Company
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Category 02